DOCUMENT RESUME

ED 232 937 SO 014 899

AUTHOR Parpia, Banoo; And Others
TITLE Socioeconomic Status and Infant Mortality in Texas, 1970-80.
PUB DATE Mar 83
NOTE 23p.; Paper presented at the Annual Meeting of the Southwestern Sociological Association (Houston, TX, March 16-19, 1983).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Demography; Ecological Factors; *Infant Mortality; Neonates; Research Problems; Social Science Research; *Socioeconomic Influences; *Socioeconomic Status
IDENTIFIERS *Texas

ABSTRACT

Results suggested that socioeconomic factors were not major determinants of differences in infant mortality in Texas in the 1970's. Data on live births and infant deaths for 254 Texas counties were obtained from the Texas Department of Health for each of the 11 years from 1970 to 1980. Infant, neonatal, and postneonatal mortality rates were calculated for each county for the 11 years and for two component periods, 1970-74 and 1975-80. Socioeconomic, demographic, and ecological factors used in the analysis were obtained from the combined 1944-77 County and City Data Book tape (U.S. Bureau of the Census, 1978) and the 1970 census data on population. The analysis is, however, clearly limited in a number of aspects that must make any conclusion derived from it extremely tentative. Limitations include failure to include relevant intervening biological and other variables in the analysis; the limited time frame and areal focus of the study; and the use of secondary and aggregate data in analyzing phenomena for which family-level social, economic, environmental, and biological factors provide the crucial context for survival. (RM)

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SOCIOECONOMIC STATUS AND INFANT MORTALITY IN TEXAS, 1970-80

by

Banoo Parpia
Steve H. Murdock
Sean-Shong Hwang
and
Rita R. Hamm

Department of Rural Sociology
Texas A&M University

SP 014 899

Paper prepared for presentation at the Annual Meetings of the Southwestern Sociological Association, Houston, Texas, March 16-19, 1983.

The infant mortality rate has declined dramatically in the U.S. in the past century as a result of the increased control of infectious diseases and improvements in health care (Garfinkel et al., 1975; Kitagawa, 1977; Kitagawa and Hauser, 1973). Differentials remain, however, between the sexes, among racial/ethnic groups and among various regions of the nation (Kitagawa, 1977). Although biological, environmental and ecological factors appear, at least in part, to explain such differences, debate continues about the extent to which the infant mortality rate is influenced by socioeconomic differences among population groups in low mortality, industrialized countries such as the U.S.

Some researchers indicate that the widely accepted inverse association between levels of socioeconomic status and infant mortality is changing in the U.S. (Willie, 1959; Stockwell, 1962; 1966; Stockwell et al., 1978; Donabedian et al., 1965). In a study of neonatal and postneonatal mortality among census tracts in Syracuse, for example, Willie found that socioeconomic status factors (including median family income, occupational and educational characteristics, the type of dwelling unit and its rental or market value) had little effect on the distribution of infant mortality rates (Willie, 1959). In a similar analysis of Providence, Rhode Island, Stockwell's findings led him to conclude that "infant mortality is no longer the extremely sensitive index of differences in socioeconomic status that it was in the past" (Stockwell, 1962). Both Willie and Stockwell,

however, distinguished between the types of determinants that effected the two components of infant mortality--neonatal and postneonatal mortality. Both noted that neonatal mortality tended to be more sensitive to physiological factors such as the health status of the mother and to biological factors related to gestation, while postneonatal mortality was more likely to reflect the use of health services and other factors that tend to vary with socioeconomic status.

Other researchers indicate that there continues to be a strong inverse association between socioecoromic factors and infant mortality (Brooks, 1975a, 1975b; Antonovsky and Bernstein, 1977; Markides and Barnes, 1977; Markides and McFarland, 1982; Gortmaker, 1979; Jibou, 1972; Adamchak, 1979). Thus, in analyzing infant mortality data from several nations in Western Europe and the U.S., Antonovsky and Bernstein found that although infant mortality had declined rapidly in the past century, the inverse relationship between social class and perinatal, neonatal and postneonatal mortality had not narrowed "in spite of advances in medicine, surgery, sanitation and housing conditions, and the overall rise in living standards which were presumed to be of special benefit to the lower classes" (Antonovsky and Bernstein, 1977). In another analysis, Adamchak (1979) indicates that socioeconomic factors are important, but the specific socioeconomic factors affecting infant mortality are likely to shift from one time period to another. Thus "in 1950, crowded housing conditions and unemployment were primarily responsible;

in 1960, it was housing and income; and in 1970, marital instability and income predominated" (Adamchak, 1979). This led Adamchak to conclude that "as new social phenomena emerge, they quickly affect sensitive indicators of well being such as the infant mortality rate." Analyses of state and county rates by Brooks (1975a, 1975b), of areas in Texas (San Antonio) by Markides and Barnes (1977) and Markides and McFarland (1982), and numerous other analyses (Gortmaker, 1979; Grossman and Jacobwitz, 1981; Jibou, 1972) also find significant direct or indirect relationships between socioeconomic factors and infant mortality. Signficantly, however, as with those analyses that have tended to find little if any relationship between socioeconomic factors and mortality, those supporting the relationship find the strongest relationship between socioeconomic factors and postneonatal mortality. Postneonatal mortality is apparently more sensitive to socioeconomic factors than neonatal mortality.

It is evident, then, that the existence of socioeconomic differentials in infant mortality and the exact nature of the effects of socioeconomic factors on infant mortality have not been clearly established. Several characteristics of such studies may partially explain the lack of consistency in the findings from them, however. One limitation of nearly all existing analyses is that they are cross-sectional, presenting data for only a single period of time. Thus, except for a few analyses (such as those by Brooks, 1975a, 1975b, and Adamchak, 1979), most analyses present data for only a single period of

time and thus cannot establish the existence of trends critical to analyzing changes in differentials. A second common feature of such analyses has been the lack of an adequate areal focus. Most of the analyses have examined either a single area such as an individual city (Willie, 1959; Stockwell, 1962; Brooks, 1980; Adamchak, 1979) or examined patterns for large areas, such as states (Brooks, 1975b). The characteristics of states and other large areas are thus often used as independent variables in these analyses. Since state characteristics may not accurately reflect the local living conditions that most directly affect infant mortality levels, analyses using data for such large areas may be problematic. Few analyses of numerous moderate-size areas such as counties (Brooks, 1975a) have been completed. Finally, many analyses simply fail to provide separate analyses of the components (neonatal and postneonatal) of infant mortality that both the proponents and opponents of socioeconomic differentials maintain must be examined separately. Overall, then, the failure to more clearly establish the existence, nature and changing effects of socioeconomic differentials on infant mortality may, in part, reflect the lack of longitudinal analyses that separately examine the components of infant mortality for a relatively large number of sufficiently small areas.

This paper attempts to address the need for such efforts by presenting the results of an analysis of the effects of socioeconomic status, and relevant demographic and ecological variables, on neonatal, postneonatal, and total infant mortality

rates for counties in the State of Texas for the 1970-80 period and on these rates for two separate components of this time period, 1970-74 and 1975-1980. The analysis reported is longitudinal, small-area oriented and includes a relatively large number of areal units. The results thus provide a useful and relatively unique means of further analyzing the relationship of socioeconomic conditions and infant mortality.

Methodology

To complete the analysis, data on live births and infant deaths for 254 counties in Texas were obtained from the Texas Department of Health for each of the 11 years from 1970-80. Infant, neonatal and postneonatal mortality rates were calculated for each county for the 11 year period and for two component periods, 1970-74 and 1975-80, using standard definitions.[1] Rates for individual years were also computed but were insufficiently stable (due to the small number of births for some years for some counties) to merit further analysis. Even using 5 year periods, 13 counties had to be eliminated from the analyses so that the results reported are for 241 counties.[2]

The independent variables used in the analysis were selected to reflect socioeconomic conditions and two alternative sets of explanations of differentials in infant mortality, demographic and ecological factors. A list of the variables initially selected as potential independent variables are shown in Table 1. These variables were obtained from the combined 1944-1977 County and City Data Book tape (U.S. Bureau of the Census, 1978) and

1970 census data on population (from the 4th count tape). Values of these parameters as of 1970 were used because 1970 values provide logical precursors of 1970-80 infant mortality patterns. Those variables used in the regression analysis were selected from this initial list of variables by using only one variable of highly correlated (.75 or above) sets of variables.[3] The 13 independent variables used in the regression analysis are marked with an asterisk in Table 1 and include 3 indicators of socioeconomic status (median family income, % white collar, median value of owner-occupied housing units), 4 demographic factors (% urban, % Black, % Spanish, % females in labor force) and 6 general ecological factors (% unemployed, % employed in agriculture, % employed in manufacturing, % employed in construction, % employed in wholesale-retail trade, and % employed in services).

Ordinary least squares regression was used to examine nine separate regression models (the results are reported in three separate tables). These include three models (one each) for neonatal, postneonatal and the total infant mortality rates for the total 1970-80 period (Table 2), three for the 1970-74 period (Table 3) and three for the 1975-80 period (Table 4). Because of the emphasis on comparing the relative effects of different types of determinants of infant mortality (socioeconomic versus demographic and ecological), standardized regression coefficients, levels of significance (at the .05 level) and R^2 values for each model are emphasized in the discussion.

Results

Table 2 presents data showing the combined effects of socioeconomic, demographic and ecological factors on infant mortality and its component parts (i.e., neonatal and postneonatal mortality) for the total 1970-80 period. The R^2 values in this table indicate that significant relationships exist between the selected county characteristics and infant mortality with a greater proportion of the variation being explained for the neonatal component of mortality than for postneonatal mortality. The R^2 values are low, however, and clearly additional factors, not included in the models, were affecting infant mortality levels in Texas during the 1970s.

The standardized regression coefficients in Table 2 indicate that for both the neonatal and the total infant mortality rates, a socioeconomic factor (the median value of housing) is the most important explanatory variable, having the expected negative effect on both neonatal and total infant mortality. Additional variables were significant in the models for these two rates, however. For the total rate, both the percent Black and the percent Spanish, and for the neonatal model the percent Spanish, had significant effects indicating that racial and ethnic status continued to have a strong effect on infant mortality in Texas in the 1970s. The sign of the coefficients for the percent Spanish is the reverse of that expected, however, and no adequate substantive explanation is apparent for this relationship.

For postneonatal mortality, the only significant coefficient

was that for percent Black, a demographic variable. Socioeconomic factors, although often found to be more significant for postneonatal than for neonatal mortality (Adamchak, 1979), were not important for explaining 1970-80 postneonatal mortality rates for Texas counties.

The data in Table 2 thus show only moderate ability for the models in predicting infant mortality in Texas from 1970-80. Although the most important variable in two of the three models is a socioeconomic factor--median value of owner occupied units--it is not the most important variable in the postneonatal model, and socioeconomic variables are only moderately important overall. The findings, thus, fail to strongly support the existence of socioeconomic differentials in infant mortality. It is perhaps equally signficant, however, that they also do not indicate substantial importance for demographic or ecological variables. The findings suggest that yet additional determinants of infant mortality must be sought.

The data in Tables 3 and 4 show the findings for the 1970-74 (Table 3) and 1975-80 (Table 4) periods. These data largely confirm those in Table 2. That is, the models predict only a moderate percentage of the variation in infant mortality and socioeconomic factors are significant for the total and neonatal rates but not for the postneonatal rates. As with the model for the total period, in the two component period models, the median value of owner occupied housing units is the most significant variable in the total and neonatal models and the only signficant

socioeconomic variable for these models. In addition, in these models, it is the percent Black and the percent Spanish that most consistently dominated the models. Overall, then, the effects of socioeconomic factors do not appear to have changed dramatically during the course of the decade and the 1970-80 period appears to be one for which socioeconomic differentials had only a small effect on infant mortality.

Two findings from the component period models are substantially different than patterns in the total model and require comment, however. Thus, it is evident that the factors included in the models predicted a significant proportion of the variation in postneonatal mortality, but not in neonatal mortality in 1970-74. However, the opposite pattern was evident for the 1975-80 period. In addition, percent Spanish, percent of females in the labor force and percent urban appeared as significant variables in the 1975-80 models but not in the 1970-74 models. Thus, variability in the predictors, and in the predictors of significance at different time periods, similar to that noted by Adamchak (1979) appear evident in Texas in the 1970s. As with Adamchak's analysis, then, the results obtained here suggest that models that seek to explain infant mortality must be complex and multifaceted.

Overall, then, the data in Tables 3 and 4 further verify the relatively weak relationship between socioeconomic factors and infant mortality found in the total model. Although variations in the results for the two component time periods are evident,

the differences between the models for the two periods do not point to significant changes in the effects of socioeconomic variables on infant mortality during different points in the 1970s.

Conclusions

The findings from this analysis fail to show strong support for a continuing effect of socioeconomic factors on infant mortality in Texas in the 1970s. Although socioeconomic factors were relatively important in several models, the models had low predictive abilities overall and showed considerable instability in the signs of coefficients. In addition, the results indicated that socioeconomic differentials had not increased or decreased in importance over time and that they were not (as had been expected) better predictors of postneonatal than of neonatal mortality. Finally, the results indicate that even with the inclusion of other demographic and ecological-economic variables, the model's ability to predict infant mortality rates did not improve substantially. The results, then, suggest that socioeconomic factors were not major determinants of differences in infant mortality from 1970-1980 and provide little indication of those factors that did affect infant mortality rates during this period.

Overall, then, despite the lack of definitive results, the findings must be seen as supporting the findings of those (Willie, 1959; Stockwell et al., 1978) who see socioeconomic

factors as playing a decreasing role in the determination of differentials in infant mortality. There is little in this analysis to suggest that socioeconomic factors were key determinants of infant mortality in Texas from 1970 to 1980.

The analysis is, however, clearly limited in a number of regards that must make any conclusion derived from it extremely tentative. One of the limitations of the present effort was the failure to include relevant intervening biological and other variables in the analysis. Variables such as the mother's level of prenatal care, illegitimacy status and the birth weight of the child were not included. The addition of such variables to the present model may have resulted in quite different results. Thus such factors have often been found (Grossman and Jacobwitz, 1981; Brooks, 1980) to serve as intervening variables between socioeconomic factors and mortality. The inclusion of such variables in regression and path analytic models might have substantially improved the predictive ability of the socioeconomic factors and of the total models and allowed the indirect as well as the direct effects of socioeconomic factors on infant mortality to be assessed.

It also appears likely that the models used here contain substantial specification errors that may have confounded the results of the analysis. Thus additional socioeconomic status variables might have been included in the analysis. The change in independent variables over time might have been examined in relation to changes in infant mortality or to mortality in 1980.

Models for subgrouping of counties might have been examined because of the diversity of environments within Texas. In sum, the models examined are only some of the many that must be analyzed and are only partially specified models relative to the possible indicators that might be included in such models.

It is also evident that the time frame and areal focus of the effort were relatively limited given that infant mortality changes slowly and is affected by factors in the immediate environment. Analyses for longer time frames, for additional areas and for smaller areal units should be examined. Thus it may be that just as state-level analyses involve data for units that are too large to correctly capture the living conditions that affect infant mortality, so county-level analyses must be replaced by ones using multiple small units (e.g., census tracts) for multiple areas (e.g., several states).

The existence of relatively strong effects for percent Black and percent Spanish suggest, in addition, that race-specific rates should be used in future analysis. Race-specific analyses are essential to separate the confounding (interactive) relationships between socioeconomic and racial factors that may have effected the results in the present analysis.

On the other hand, the results showing racial effects suggest that the racial composition of a population may have effects in addition to those that occur due to the lower socioeconomic status of minority groups. Thus the possibility that direct or indirect discriminatory practices in health care

provision and in child care may affect levels of infant mortality cannot be dismissed and may merit additional attention.

Finally, it is evident that there are clear limitations to the use of secondary and aggregate data in analyzing phenomena for which family-level social, economic, environmental and biological factors provide the crucial context for survival. The fact that one can obtain only an approximate, and often crude, assessment of that context with aggregate and secondary data must be recognized. Primary data remain crucial for completing definitive analyses of the causes of infant mortality.

Clearly, additional analysis of 1970-80 trends in infant mortality in Texas are essential. Such analyses will require substantial conceptual and methdological refinement if the determinants of differentials in infant mortality, and the role of socioeconomic factors in that determination, are to be established. Significant challenges thus remain for demographers interested in the analysis of the causes and consequences of trends in infant mortality.

Notes

[1]These rates are:

$$\text{Infant mortality rate} = \frac{\text{Number of deaths at 0-364 days}}{\text{Number of live births}} \times 1000$$

$$\text{Neonatal mortality rate} = \frac{\text{Number of deaths at 0-27 days}}{\text{Number of live births}} \times 1000$$

$$\text{Postneonatal mortality rate} = \frac{\text{Number of deaths 28-364 days}}{\text{Number of live births}} \times 1000$$

[2]These 13 counties were eliminated because they had less than 100 live births for the 1970-74 period and rates based on less than 100 cases often provide misleading results.

[3]Other variables, specifically, local government expenditures, were not included in the model due to a large number of missing values for these factors for several counties. In addition, indicators of medical services such as the number of physicians/1000, number of hospital beds and number of hospitals were not included in the final analysis because the initial correlation analysis indicated that they had only a small effect (low r values) on infant mortality.

TABLE 1

Independent Variables Included in Analysis by Category

Socioeconomic

- Median years of school completed by persons 25 years of age or older, 1970 (median education)
- Median family income, 1970*
- Percent employed in white-collar occupations, 1970 (% white-collar)*
- Median value of single family owner occupied units, 1970 (median value oou)*
- % of families with income < $3000, 1970

Demographic

- % urban, 1970*
- % Black, 1970*
- % Spanish, 1970*
- % females in civilian labor force, 1970 (% females in labor force)*

Ecological

- % unemployed, 1970*
- % employed in agriculture, 1970 (% agriculture)*
- % employed in manufacturing, 1970 (% manufacturing)*
- % employed in construction, 1970 (% construction)*
- % employed in wholesale and retail trade, 1970 (% wholesale-retail)*
- % employed in services, 1970 (% services)*
- Local government expenditures:
  - % spent for education, 1970
  - % spent for public welfare, 1970
  - % spent for health and hospitals, 1970
- Number of physicians/1000 persons, 1975
- Number of hospital beds, 1975
- Number of hospitals, 1975

( ) Names in parentheses indicate abbreviations used in subsequent tables

* Indicates variables selected for use in regression analysis

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TABLE 2

Standardized Regression Coefficients and Multiple Coefficients of Determination (R^2) for Regression of 1970 Socioeconomic, Demographic and Ecological Factors for Texas Counties on 1970-1980 Infant Mortality, Neonatal Mortality and Postneonatal Mortality Rates

Variable	Infant Mortality	Neonatal Mortality	Postneonatal Mortality
Socioeconomic			
Median family Income	.143	.195	-.036
% white collar	.105	.130	-.005
Median value ooo	-.343*	-.367*	-.086
Demographic			
% urban	.059	.088	-.028
% Black	.252*	.114	.333*
% Spanish	-.193*	-.242*	.012
% females in labor force	-.106	-.108	-.036
Ecological			
% unemployed	.036	.053	-.016
% agriculture	.113	.010	.222
% manufacturing	-.192	-.240	.013
% construction	-.130	-.097	-.104
% wholesale-retail	-.049	.074	.025
% services	-.146	-.182	.007
R2	.2235*	.1671*	.1522*

*indicates significance at the .05 level

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TABLE 3

Standardized Regression Coefficients and Multiple Coefficients of Determination (R^2) for Regression of 1970 Socioeconomic, Demographic and Ecological Factors for Texas Counties on 1970-1974 Infant Mortality, Neonatal Mortality and Postneonatal Mortality Rates

Variable	Infant Mortality	Neonatal Mortality	Postneonatal Mortality
Socioeconomic			
Median family Income	.108	.165	-.068
% white collar	.092	.067	.073
Median value oou	-.297*	-.286*	-.113
Demographic			
% urban	-.024	-.076	.086
% Black	.215*	.111	.251*
% Spanish	-.036	-.063	.036
% females in labor force	.004	-.0003	.009
Ecological			
% unemployed	-.032	-.005	-.057
% agriculture	.070	-.033	.205
% manufacturing	-.172	-.142	-.107
% construction	-.168	-.167	-.053
% wholesale-retail	-.039	.003	-.085
% services	-.104	-.065	-.102
R2	.1530*	.0890	.1266*

*indicates significance at the .05 level

TABLE 4

Standardized Regression Coefficients and Multiple Coefficients of Determinants (R^2) for Regression of 1970 Socioeconomic, Demographic and Ecological Factors for Texas Counties on 1975-1980 Infant Mortality, Neonatal Mortality and Postneonatal Mortality Rates

Variable	Infant Mortality	Neonatal Mortality	Postneonatal Mortality
Socioeconomic			
Median family Income	.155	.187	.015
% white collar	.063	.131	-.077
Median value oou	-.235*	-.291*	-.009
Demographic			
% urban	.111	.220*	-.121
% Black	.183*	.075	.238*
% Spanish	-.255*	-.318*	-.007
% females in labor force	-.178*	-.188	-.056
Ecological			
% unemployed	.078	.087	.017
% agriculture	.108	.100	.056
% manufacturing	-.120	-.201	.073
% construction	-.014	.054	-.108
% wholesale-retail	-.033	-.102	.091
% services	-.125	-.203	.068
R2	.1554*	.1855*	.0868

*indicates significance at the .05 level

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